

# ARC HYDRO GROUNDWATER TUTORIALS

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## ***Subsurface Analyst – Adding XS2D points to cross sections***

Arc Hydro Groundwater (AHGW) is a geodatabase design for representing groundwater datasets within ArcGIS. The data model helps to archive, display, and analyze multidimensional groundwater data, and includes several components to represent different types of datasets, including representations of aquifers and wells/boreholes, 3D hydrogeologic models, temporal information, and data from simulation models. The *Arc Hydro Groundwater Tools* help to import, edit, and manage groundwater data stored in an AHGW geodatabase. *Subsurface Analyst* is a subset of the AHGW Tools that is used to manage 2D and 3D hydrogeologic data, and create subsurface models including generation of borehole representations, cross sections, surfaces, and volumes.

This tutorial will demonstrate how to transform points and lines to existing cross sections.

### **1.1 Background**

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This tutorial will demonstrate how to add points to existing cross sections. A separate tutorial, named “Creating 2D Cross Sections”, describes the process of creating 2D cross sections in ArcMap. The result from that tutorial is a map document with two cross section data frames A-A' and B-B'. In this tutorial, additional information will be added from point and line features representing transportation features (roads and railroad) and gas stations (Figure 1). Data used in this tutorial was modified from its original source and some of the data are mock datasets created for the purpose of this tutorial.

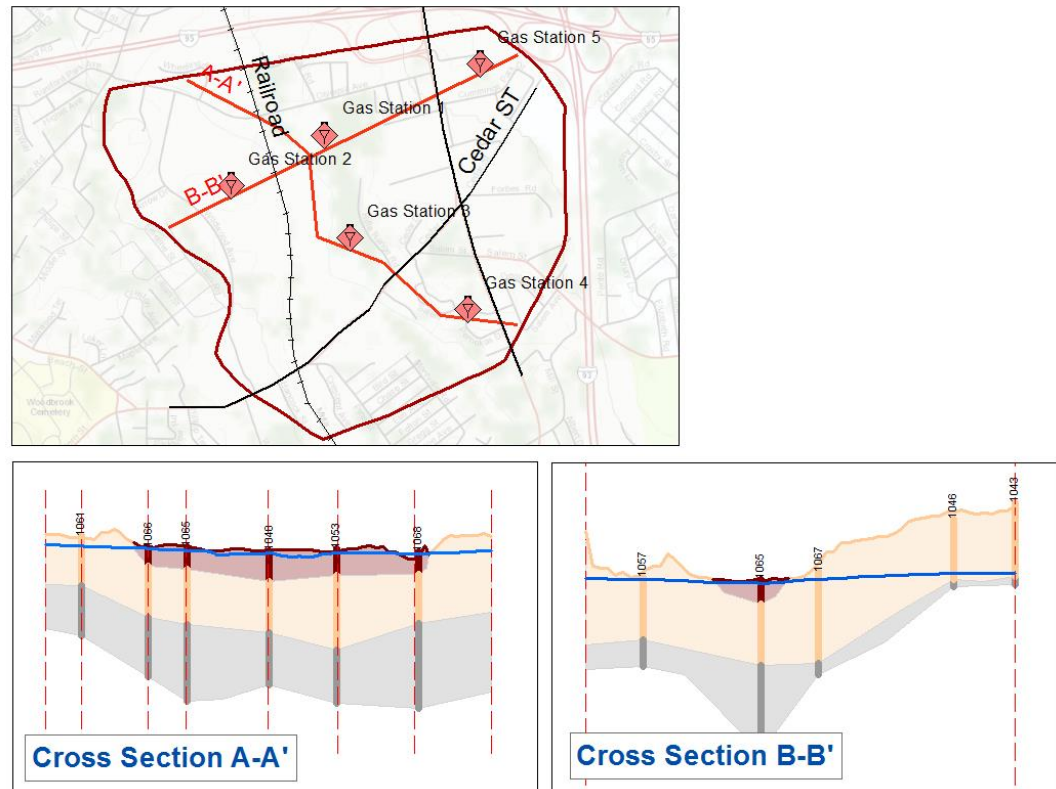


Figure 1 Map layout including overview map and cross sections A-A' and B-B' created in a previous tutorial

## 1.2 Outline

The objective of this tutorial is to introduce the basic workflow and tools for transforming lines and point features onto cross sections in ArcMap. The tutorial includes the following steps:

1. Create an XS2D Point feature class for storing new XS2D point features.
2. Transform lines to XS2D Points.
3. Transform points to XS2D Points.
4. Visualize the transformed features in the cross sections.

## 1.3 Required Modules/Interfaces

The following components should be enabled in order to complete this tutorial:

- ArcGIS for Desktop license (Basic\Standard\Advanced).
- Arc Hydro Groundwater Tools.





- AHGW Tutorial Files.

The AHGW Tools require that a compatible ArcGIS service pack be installed. Check the AHGW Tools documentation to find the appropriate service pack for your version of the tools. The tutorial files should be downloaded and saved on a local drive.

## 2 Getting Started

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Before opening the tutorial map, let's ensure that the AHGW Tools are correctly configured.

1. If necessary, launch *ArcMap*.
2. Open the ArcToolbox window by clicking **ArcToolbox** .
3. If “ Arc Hydro Groundwater Tools” is not in the list of available toolboxes, follow steps 4–6. If it is already listed, skip to step 7.
4. Right-click anywhere in the *ArcToolbox* window and select **Add Toolbox...** to bring up the *Add Toolbox* dialog.
5. Browse to the *Toolboxes\System Toolboxes* folder and select “Arc Hydro Groundwater Tools.tbx”.
6. Click **Open** to exit the *Add Toolbox* dialog.
7. Expand “ Arc Hydro Groundwater Tools”.
8. Expand “ Subsurface Analyst”.

Note that many of the geoprocessing (GP) tools in the *AHGW Toolbox* can also be accessed from the AHGW Toolbar. The toolbar contains additional user interface components not available in the toolbox. If the toolbar is not visible, do the following::

9. Right-click on any visible toolbar and select **Arc Hydro Groundwater Toolbar** to make it visible. Feel free to dock it at the top of the ArcMap window.

When using geoprocessing tools you can set the tools to overwrite outputs by default, and automatically add results to the map/scene. To set these options:

10. Select *Geoprocessing / Geoprocessing Options...* to bring up the *Geoprocessing Options* dialog.
11. In the *General* section, turn on *Overwrite the outputs of geoprocessing operations*.
12. In the *Display / Temporary Data* section, turn on *Add results of geoprocessing operations to the display*.

13. Click **OK** to exit the *Geoprocessing Options* dialog.

### 3 Opening the Map

Begin by opening a map containing some background data for the project.

1. Select *File* | **Open...** to bring up the *Open* dialog.
2. Browse to the *Tutorials\subsurface analyst\XS2D Points* folder.
3. Select “Woburn\_xs2d\_points.mxd” and click **Open** to exit the *Open* dialog and import the model file

Once the file has loaded, a map of the model domain with pre-created cross sections should appear (Figure 2).

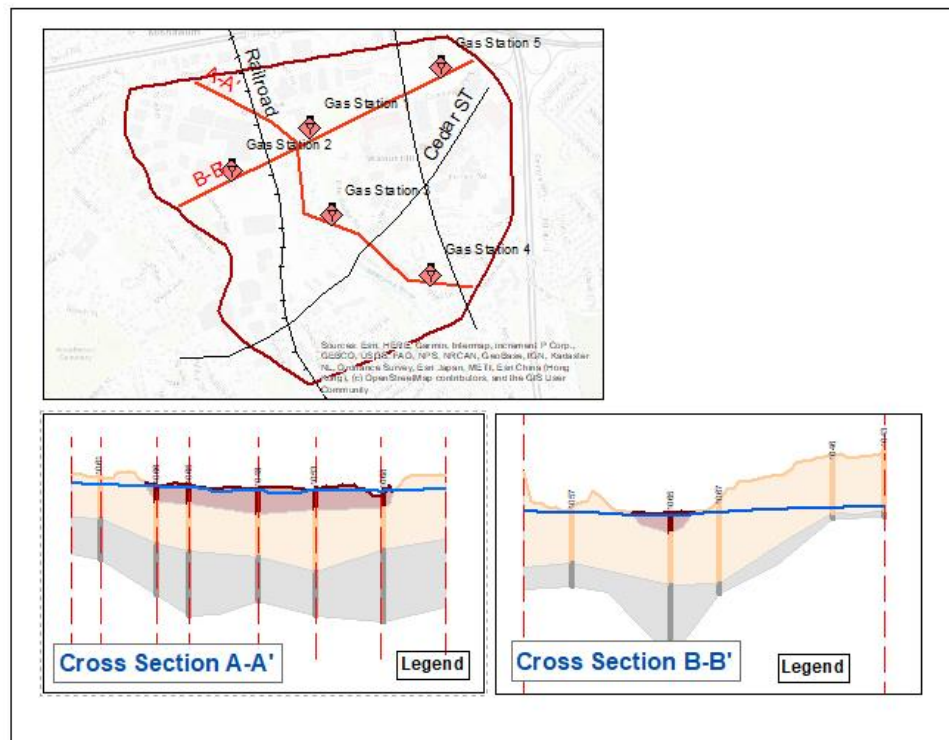



Figure 2 Map of the model domain with cross sections

### 4 Creating an XS2D Point Feature Class

This tutorial will show how to transform transportation features (lines) and gas stations (points) into XS2D points. Before transforming features to the cross sections, create feature classes to hold the transformed lines/points.

1. In the *Table of Contents*, right-click on “Layers” and select **Activate**.
2. Expand the “XS2D Editor” toolset under the “Subsurface Analyst” toolset.

3. Double-click on the “ Create XS2D Point Feature Class” tool to open the *Create XS2D Point Feature Class* dialog.
4. For *Input Section Line Features* select “SectionLine”.
5. For *Input XS2D Catalog Table* select “XS2D\_Catelog”.
6. For *XS2DType value of the XS2D Point features* enter “XS2DPoints”.
7. For *Feature Class Name Prefix* enter “XS2DPoints”.
8. Select **OK** to close the *Create XS2D Point Feature Class* dialog and run the tool.


Upon completion, two layers (XS2DPoints\_1 and XS2DPoints\_2) should be added to the Table of Contents, one for SectionLine with HydroID = 1 and one for SectionLine with HydroID = 2.

If the layers do not appear in the Layers data frame, add them from the *woburn\_xs2d\_points.mdb/Data* feature dataset.

## 5 Transforming Line and Point Features to XS2D Points


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Next, populate the new XS2D point feature classes by transforming lines representing transportation features (railroad and roads). The features are intersected with the section lines and elevations can be read from a raster surface (e.g. digital elevation model). This forms a 3D point which is projected onto the selected cross section.

1. Double-click on the “ Transform Lines to XS2D Points” tool to open the *Transform Lines to XS2D Points* dialog.
2. For *Input Polyline Features* select “Transportation.”
3. For *Input Section Line Features* select “SectionLine”.
4. For *Input XS2D\_Catalog Table* select “XS2D\_Catelog”.
5. For *XS2DType* select “XS2DPoints”. Note that this value is read from the XS2D\_Catelog table and is based on the input provided when creating the XS2D point feature class.
6. For *FType value of the features to create* enter “Transportation”. This value will be written to the FType field in the new XS2D point features.
7. For *Ground Surface DEM or Raster Elevation Source* select “dem100ft”.
8. Leave the *Overwrite Existing XS2D Point Features* option turned on.
9. Select **OK** to close the *Transform Lines to XS2D Points* dialog and run the tool.



When finished, new features should be added to the XS2DPoints\_1 and XS2DPoints\_2 feature classes.

To view the new points on the cross section:

1. Change the Table of Contents to **List By Drawing Order** .
2. Drag “XS2DPoints\_1” onto the A-A’ data frame.
3. Drag “XS2DPoints\_2” onto the B-B’ data frame.

The XS2D point features should appear in the cross sections.

Next, transform point features representing gas stations and append them to the XS2D point feature class:

4. In the *Table of Contents*, right-click on “ Layers” and select **Activate**.
5. Using the **Select Features**  tool, hold down the *Shift* key then select the SectionLine A-A’ and Gas Stations 1 ,3 and 4.

At this point the selections should be similar to Figure 3. When we run the transform tool only the selected points will be projected to the selected cross sections.

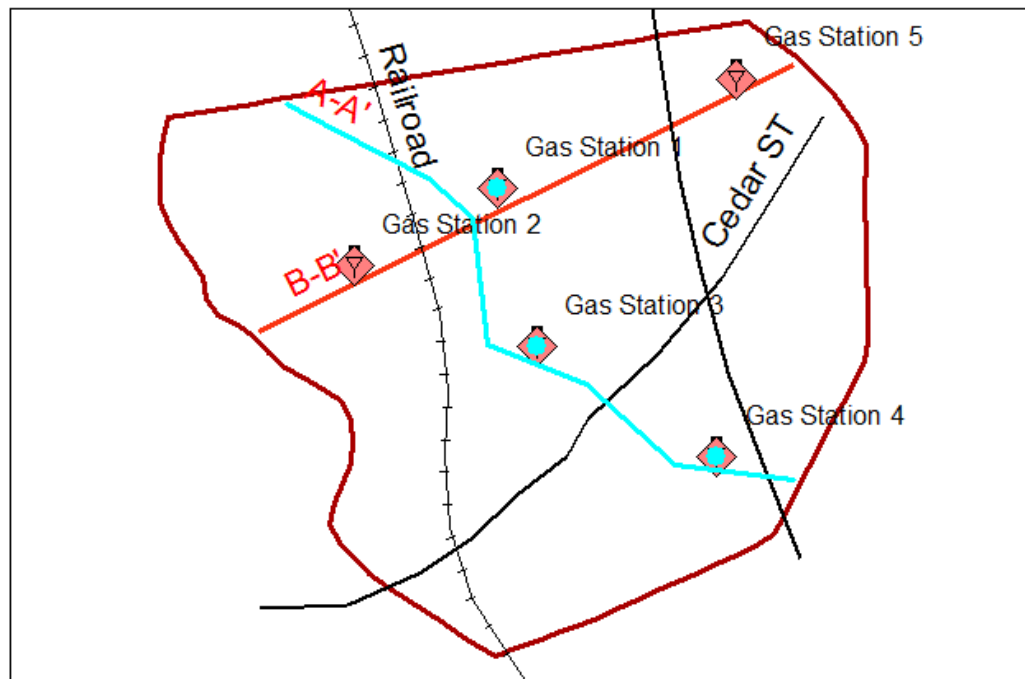





Figure 3 Selection of features before running the Transform Points to XS2D Points tool

6. Double-click on the “ Transform Points to XS2D Points” tool to open the *Transform Points to XS2D Points* dialog.

7. For *Input Point Features* select “GasStations”.
8. For *Input Section Line Features* select “SectionLine”.
9. For *Input XS2D\_Catalog Table* select “XS2D\_Categog”.
10. For *XS2DType* select “XS2DPoints”.
11. For *FType value of the features to create* enter “Gas station”. This value will be written to the FType field in the new XS2D point features.
12. For *Ground Surface DEM or Raster Elevation Source* select “dem100ft”.
13. Turn off the *Overwrite Existing XS2D Point Features* option.
14. Select **OK** to close the *Transform Points to XS2D Points* dialog and run the tool.
15. Select *F5* to refresh.

Upon completion, a set of points will be added to the XS2DPoints\_1 feature class. Now to symbolize the features based on their type.

To symbolize the XS2D points:

16. In the *Table of Contents*, right-click on “ Section A-A” and select **Activate**.
17. Under “ Section A-A”, right-click on “XS2DPoints\_1” and a select *Properties* to open the *Layer Properties* dialog.
18. Select the *Symbolology* tab.
19. In the *Show* section, select *Categories / Unique values*.
20. Change the *Value Field* to “FType”.
21. Click **Add All Values**.
22. Modify the colors and size of the symbols as desired.
23. When done, click **OK** to close the *Layer Properties* dialog.

At the end of this process you should have XS2D points showing the intersection of line features (representing railroads and roads) with section line A-A', and the location of point features (e.g. gas stations) along the section line (Figure 4).

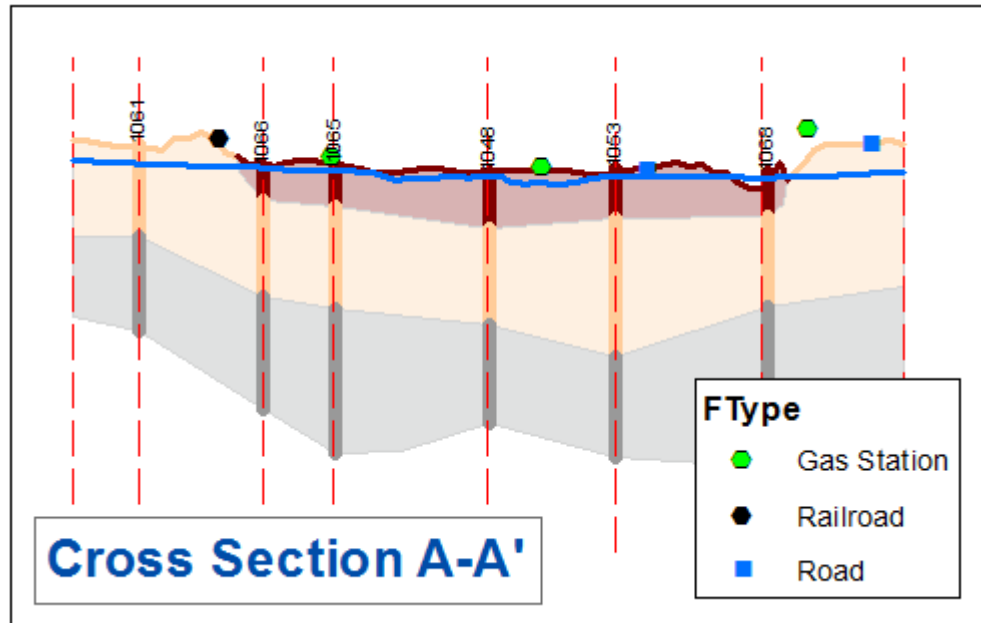


Figure 4 XS2D Points added to cross section A-A'

24. Repeat steps 4–23 to add and symbolize points in cross section B-B'. In step 5 change the selection to B-B' section line and to gas stations 2, 1, and 5 along section line B-B'.

Upon completion, cross section B-B' should be similar to the one shown in Figure 5.

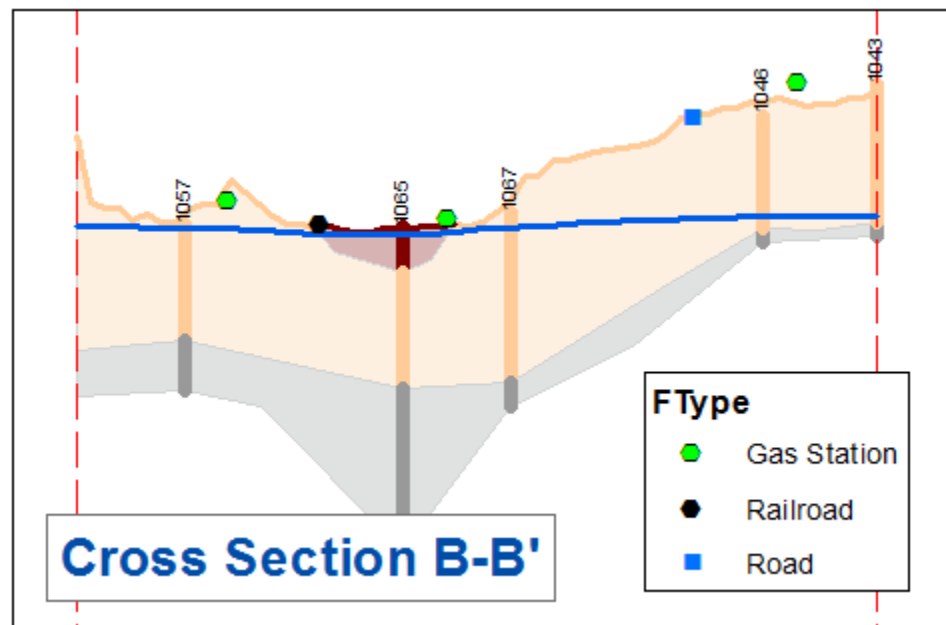


Figure 5 XS2D Points added to cross section B-B'



## 6 Conclusion

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This concludes the tutorial. Here are some of the key concepts in this tutorial:

- XS2D points can be added to a cross section to represent a wide array of features.
- The *Transform Lines To XS2D Points* tool creates XS2D Points representing the intersection of line features with section lines.
- The *Transform Points To XS2D Points* creates XS2D Points representing point features along the section lines.